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Conduct problems co-occur with hyperactivity in children with language impairment: A longitudinal study from childhood to adolescence

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Abstract

Background: Language impairment is a common developmental disorder which is frequently associated with externalising problems. In this study, we investigate for the first time, joint trajectories of conduct problems and hyperactivity in children with language impairment from childhood to adolescence. We determine patterns of co-occurrence of symptoms and identify specific risk and protective factors.

Methods: We develop a trajectory grouping method to examine simultaneously the conduct and hyperactivity problem scores of 164 children with language impairment at 7, 8, 11 and 16 years of age.

Results: We identified five groups of children with distinct trajectories of symptoms. Three trajectory groups all had different conduct/hyperactivity problems: a persistent problems group (15%), an adolescent-onset group (24%) and a childhood-limited group (17%). There were two trajectory groups that did not show conduct problems.

Conclusions: Conduct problems always co-occurred with hyperactivity in children with language impairment regardless of differences in the onset of symptoms (childhood versus adolescence) or their persistence (persistent versus childhood limited). Reading difficulties were strongly associated with mixed conduct/hyperactivity problems that started early (childhood) and continued into adolescence (the persistent trajectory group). Prosocial behaviours were found to be protective against conduct problems.

Keywords

Language impairment, joint longitudinal trajectories, conduct problems, hyperactivity, risk factors, protective factors

Language impairment (LI) is a developmental disorder affecting 7% of children at school entry (Hannus, Kauppila, & Launonen, 2009; Tomblin et al., 1997). For many, language difficulties are persistent (Brizzolara et al., 2011; Conti-Ramsden, St.Clair, Pickles, & Durkin, 2012; de Bree, Wijnen, & Gerrits, 2010; Miniscalco, Westerlund, & Lohmander, 2005). LI is much more common than autism spectrum disorders (1%, Baird et al., 2006), yet public awareness about LI and its associated strengths and difficulties remains limited (see Raising Awareness of Language Learning Impairments, RALLI Campaign, https://www.youtube.com/user/RALLIcampaign). LI not only poses challenges to children's healthy development but it is also frequently associated with a variety of forms of externalising problems (Benner, Nelson, &

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Epstein, 2002; Toppelberg & Shapiro, 2000). Studies of children with LI have reported increased risk for conduct problems (Van Daal, Verhoeven, & Van Balkom, 2007) and high rates of difficulties in attention and hyperactivity (Snowling, Bishop, Stothard, Chipchase, & Kaplan, 2006). Attention deficit and hyperactivity disorder (ADHD) is the most common psychiatric diagnosis of children with LI (Cohen et al., 2000). Longitudinal research involving typically developing children, suggest language and behaviour are related in the general population. For example, Hartas (2011) who followed up a community sample of pre-schoolers using a teacher-rated questionnaire found moderate associations between vocabulary and problem behaviour (but not prosocial behaviour). Evidence at the population level also indicates conduct and hyperactivity can co-occur but they can also occur in isolation. There are children with predominantly hyperactivity problems, children with conduct problems alone (without hyperactivity) and children with mixed difficulties involving both conduct and hyperactivity (D'Amico et al., 2014; Lahey, Loeber, Burke, Rathouz, & McBurnett, 2002; Rutter, Tizard, Yule, Graham, & Whitmore, 1976; Taylor, Sandberg, Thorley, & Giles, 1991). The co-occurrence of conduct problems and hyperactivity is more likely in children whose problems begin early in life and persist through to adolescence and adulthood (Moffitt, Caspi, Dickson, Silva, & Stanton, 1996).

Most of the investigations involving children with LI, however, have been small in scale and cross-sectional in nature. Longitudinal studies are much scarcer, and they tend to examine individual domains of functioning. Investigations examining outcomes of groups of children with LI at various follow-up ages have found strong links between LI and conduct problems (Beitchman et al., 1996; Howlin, Mawhood, & Rutter, 2000) and also LI and hyperactivity. Children with LI are over one and half times more likely to meet criteria for ADHD in later childhood and adolescence than their peers (Conti-Ramsden, 2013; Yew & O'Kearney, 2013). Longitudinal data from children with LI in the Manchester Language Study (MLS) showed elevated mean rates for conduct symptoms in childhood but not in adolescence. When examining hyperactivity, rates were elevated above population norms during childhood, though again this was not the case by age 16 (St Clair, Pickles, Durkin, & Conti-Ramsden, 2011). These investigations, while characterising developmental patterns of associations for children with LI generally, do not examine potential individual differences or subgroups of children who may have quite divergent experiences.

Latent trajectory modelling has proven a valuable methodology for charting pathways of problem behaviour (Mok, Pickles, Durkin, & Conti-Ramsden, 2014; Pingault et al., 2011). This approach identifies subgroups of individuals with similar developmental profiles of symptoms in a particular domain. Given that conduct problems and hyperactivity can be comorbid (Lahey et al., 2002). In this investigation, we extend latent trajectory modelling to examine joint trajectories, that is, co-occurrence of conduct and hyperactivity symptoms. To our knowledge, this is the first study to examine simultaneously trajectories of conduct/hyperactivity symptoms in children with LI from childhood to adolescence. We also investigate factors that may moderate developmental associations between LI, conduct problems and hyperactivity. We examined gender, language, literacy and prosociality. We were interested in studying risk factors as well as potential protective, buffering effects.

Higher rates of conduct problems and higher rates of hyperactivity have been reported for boys with LI when compared to girls (Tallal, Dukett, & Curtis, 1989). However, gender differences have not been observed when other variables such as language abilities have been controlled for (Benasich, Curtiss, & Tallal, 1993) or when larger samples have been studied (Maggio et al., 2013). In this study, we examine sex ratios for each of the trajectory groups identified. In the same vein, the association between language abilities and externalising problems has been somewhat mixed, depending on the symptoms examined and the types of measures used. Severity of LI as measured by overall language indices and performance IQ (PIQ) has been found to be associated with conduct problems (Lindsay, Dockrell, & Strand, 2007) and hyperactivity (Redmond & Rice, 2002). Researchers have also argued that expressive language difficulties are more likely to be associated with conduct problems (van Daal et al., 2007) and hyperactivity (Snowling et al., 2006). Nonetheless, significant associations between severity or type of LI and conduct/hyperactivity have not always been observed in larger cohort studies (Yew & O'Kearney, 2015). With regard to literacy, findings are more consistent. In the general population, problems with reading have been found to be strongly associated with antisocial behaviour and conduct problems (Maughan, Pickles, Hagell, Rutter, & Yule, 1996). Interestingly, children with LI have a high risk of reading difficulties (Bishop & Snowling, 2004; Botting, Simkin, & Conti-Ramsden, 2006). Tomblin and colleagues (2000), for example, found that approximately 50% of children with LI had reading difficulties. Furthermore, their data indicated that conduct/hyperactivity problems occurred mainly in children with LI who also had reading difficulties. Reading difficulties was the key factor predicting externalising problems in children with LI. In this investigation, we examine both oral language as well as reading abilities of children following different trajectories of conduct/hyperactivity symptoms.

Children with LI are sociable (Wadman, Durkin, & Conti-Ramsden, 2008). Furthermore, there is accumulating evidence that children with LI are also prosocial (Conti-Ramsden, Mok, Pickles, & Durkin, 2013), and that this is a key characteristic differentiating children with LI and children with autism spectrum disorders (Charman, Ricketts, Dockrell, Lindsay, & Palikara, 2015). Children with LI who are more prosocial have more positive peer relations and better social outcomes (Mok et al., 2014). Do prosocial behaviours also act as a protective factor in relation to other areas of functioning such as conduct and hyperactivity?

In this study, we investigate joint trajectories of conduct problems and hyperactivity between the ages of 7 and 16 in individuals who participated in the MLS; a cohort study of children initially identified through language problems. We determine distinct patterns of co-occurrence of conduct and hyperactivity symptoms and their association with specific risk and protective factors.

Method

Participants

Participants have a history of LI and were originally part of a wider study (Conti-Ramsden & Botting, 1999a, 1999b; Conti-Ramsden, Crutchley, & Botting, 1997): the MLS. The initial cohort of 242 children (6;6–7;9 years) was a random sample of 50% of all seven-year-olds attending 118 language units across England. Language units are specialised centres with classes for children who have been identified with primary speech and language difficulties; the units are usually attached to mainstream schools. Children with frank neurological difficulties, hearing impairment, a diagnosis of autism or a general learning disability were excluded. Participants were re-assessed at later ages. Measures of teacher-reported conduct problems and hyperactivity were available at ages 7, 8, 11 and 16. Only individuals who had these measures for at least three of the four time points were included in this study: total of 164 children (25% girls). The attrition observed was partly due to funding constraints at follow-up stages of the study. There were no significant differences in receptive language, expressive language and PIQ standard scores at age 7 between those who participated at age 16 and those who did not, all p values for each of the comparisons $> .2$. Table 1 presents means and standard deviations of the conduct and hyperactivity scores at each of the time points for the group as a whole.

Measures of conduct and hyperactivity from childhood to adolescence. Teacher-rated conduct problems and hyperactivity were obtained using the Rutter-B Children's Behaviour Questionnaire (Rutter, 1967) at ages 7, 8 and 11, the Strengths and Difficulties Questionnaire (SDQ, Goodman, 1997) at ages 11 and 16. SDQ teacher scores can range from 0 to 10 and can be classified as 'normal' (0–2), 'borderline' (3) and 'abnormal' (4–10) for conduct problems and as 'normal' (0–5), 'borderline' (6) and 'abnormal' (7–10) for hyperactivity. Examples of items for conduct include: 'Often has temper tantrums or hot tempers', 'Often fights with other children', 'Generally obedient (Reverse scored)', 'Often lies and cheats' and 'Steals from home, school or elsewhere'. For hyperactivity, items include restlessness/fidgeting items such as 'Restless, overactive', 'Constantly fidgeting or squirming', as well as distractibility/task completion items such as 'Easily distracted, concentration wanders', 'Sees tasks through to the end'.

Table 1. Mean (SD) conduct problem and hyperactivity scores of study cohort.

	Age 7	Age 8	Age 11	Age 16
Rutter conduct problem	1.0 (1.7)	1.1 (2.0)	1.3 (2.2)	–
SDQ conduct problem	–	–	1.4 (2.1)	1.0 (1.6)
Rutter hyperactivity	1.5 (1.9)	1.7 (2.0)	1.9 (1.6)	–
SDQ hyperactivity	–	–	3.9 (2.5)	3.4 (2.8)

SDQ: Strengths and Difficulties Questionnaire.

Additional measures

Measures at age 11 years (midpoint in the trajectories) were used to examine associated characteristics of the different groups. The areas covered and instruments used are described below.

Expressive and receptive language. Expressive language was measured by the Recalling Sentences subtest of the Clinical Evaluation of Language Fundamentals-Revised (Semel, Wiig, Secord, & Sabers, 1987). Receptive language was assessed using the Test for Reception of Grammar (Bishop, 1982).

Performance IQ. Block Design and Picture Completion subtests of the Wechsler Intelligence Scale for Children – Third Edition UK (Wechsler, 1992) were used to assess participant's PIQ at age 11 years.

Reading. Reading accuracy and reading comprehension were measured at 11 years of age using the Basic Reading and the Reading Comprehension subtests of the Wechsler Objective Reading Dimensions (Wechsler, 1993).

Prosociality. SDQ (Goodman, 1997): teacher-rated prosociality was obtained at age 11. Examples of items

include: 'Considerate of other people's feelings', 'Shares readily with other children', 'Helpful if someone is hurt', 'Often volunteers to help others'. Scores in the prosocial scale can range from 0 to 10 and can be classified as 'normal' (6–10), 'borderline' (5) and 'abnormal' (0–4). In contrast to other scales in the SDQ, the prosocial scale is positive: the higher the score the fewer the problems.

Ethics

The study received ethical approval from The University of Manchester Research Ethics committee, UK. Parents/legal guardians provided informed consent for all participants up to the age of 16 years. Participants themselves were asked if they wished to take part (at all phases) and provided written informed consent at 16.

Statistical analyses

All statistical analyses were conducted within Stata/SE 12.0. We wished to distinguish groups of children who, having made allowance for occasion-specific fluctuations in the measured behaviours, shared common underlying levels and trajectories of conduct and hyperactive symptoms. Referred to as a multivariate latent-class growth model, this model-based cluster analysis was estimated using the 'generalized linear latent and mixed models' (www.gllamm.org). Since the behavioural scores were skewed, we modelled them using a mixed Poisson growth curve (rather than normal) with the expected score allowed to vary on the basis of the intercept (relating to the overall level/severity of the hyperactivity/conduct problem), linear trends (allowing for differences in linear trajectory) and quadratic trends (allowing for differences in curvilinear trajectory). To allow for the use of different questionnaires (Rutter-B or SDQ) earlier and later in the study, the models included a dummy variable for each measure in the fixed (mean) part of the model. With a log-link function, this acts to rescale the shared fixed and random parts of the linear predictor that define the trajectory of each class to the response range of each questionnaire. Thus, the model provides in effect a common scale that affords the examination of trends over time. We felt confident with this approach as the examination of trends over time across these same two measures in general population cohorts has been previously described (Collishaw, Maughan, Goodman, & Pickles, 2004). The chosen model was then used to calculate for each participant the empirical Bayes' estimates for the posterior probability of belonging to each class, and each participant was assigned to the class with the highest posterior probability. The characteristics of children assigned to each class was then examined, chi-square being used to examine the distribution of gender across the trajectory groups and one-way analysis of variances (ANOVAs) to investigate differences between trajectory groups with respect to language, PIQ, reading skills and prosociality. Significant ANOVAs were investigated further using pairwise comparisons. All reported p values are two-tailed.

Sample attrition is a common problem in cohort studies, and the MLS is no exception. Attrition not only reduces the available sample size and thus statistical power, but where the attrition is selective can also introduce bias. The latent-class growth models were fitted using full maximum likelihood in order to make use of all participants, both those with complete and incomplete data. It is not unusual for attrition to be selective for participants with difficulties (Weinberger, Tublin, Ford, & Feldman, 1990). We found that the rate of attrition at age 16 was higher in the persistent group (48%) when compared to 23% in the low-level/no-problem group. There is scope for bias in the simple overall sample means for measures at age 16; however, conditioning on group – for example, examining the means by group – will account for much of this bias and weighting by group prevalence provides attrition-corrected prevalence estimates at 16.

Results

Identifying distinctive trajectories of conduct and hyperactivity symptoms

We chose the five-class model (Akaike information criterion = 4516.37; BIC = 4603.16) as a parsimonious representation of the common diversity of patterns of development of conduct and hyperactivity symptoms, and one where children were assigned with considerable confidence to their most likely trajectory class, henceforth referred to as 'group' for ease of reading. Figures 1 and 2 present the five groups of children with distinctive trajectories of conduct and hyperactivity symptoms.

The Persistent group (15% of the sample, with mean assignment probability of 0.99) had consistently high levels of problems in both hyperactivity and conduct domains though seeming to peak in early adolescence. A quarter of the sample fell in the adolescent-onset group (24%, mean assignment probability 0.90). These children's trajectories began without problems in either domain but these grew progressively to levels of considerable concern by age 16. The childhood-limited group (17%, mean assignment probability 0.89) began with similar scores (in particular for hyperactivity) and was of similar size to the persistent group, but their problems with respect to both conduct and hyperactivity were progressively resolved by age 16.

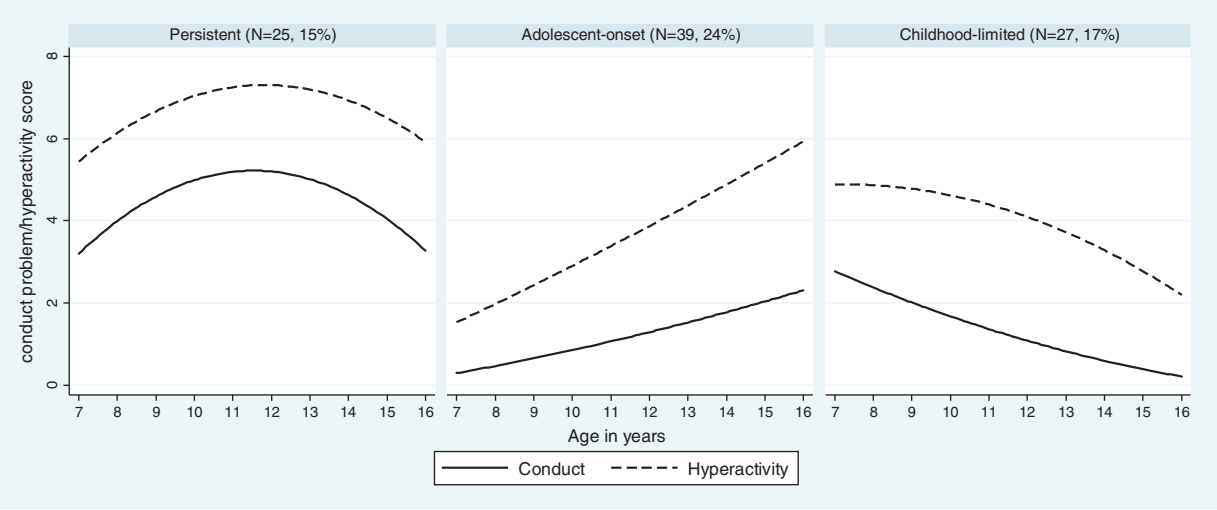

Figure 1. Predicted conduct problem and hyperactivity scores on the SDQ scale for the persistent, adolescent-onset and childhood-limited trajectory groups.

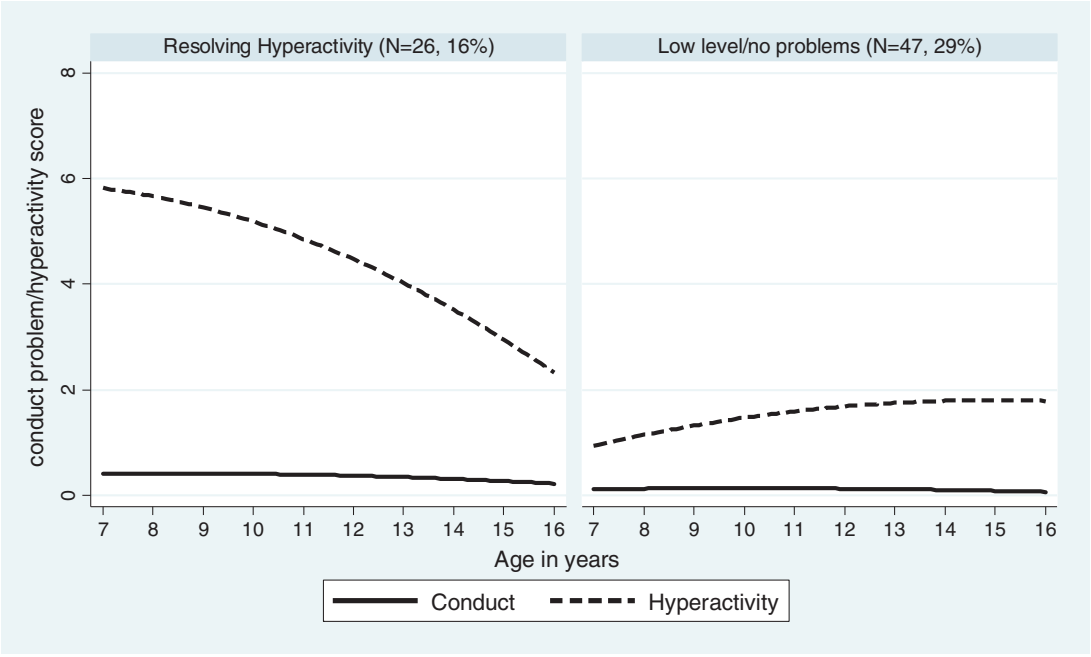

Figure 2. Predicted conduct problem and hyperactivity scores on the SDQ scale for the resolving hyperactivity and low-level/no-problems trajectory groups.

There were two trajectory groups that did not show conduct problems (see Figure 2). Nearly 30% of children (29%, mean assignment probability 0.94) did not appear to have problems in either domain from childhood to adolescence. These children fell in the low-level/no-problem group. We also found a group of children with only hyperactivity problems. The resolving hyperactivity group (16%, mean assignment probability 0.91) showed elevated hyperactivity scores in childhood that progressively resolved by age 16. Interestingly, the hyperactivity symptom profile of the resolving hyperactivity group revealed greater difficulties with distractibility/task completion (for example, items such as 'Easily distracted, concentration wanders', 'Sees tasks through to the end') rather than restlessness/fidgeting items (when compared to the profile of other groups in which conduct always co-occurred with hyperactivity).

Gender, language, reading and prosociality

There were no significant differences in gender distribution across the trajectory groups, χ^2 (4, $N = 164$) = 2.416, $p = .660$. Table 2 shows the gender distribution and mean scores for each trajectory group as well as rates of conduct problems and hyperactivity at both 11 and 16.

Findings for language, PIQ, reading and prosociality are presented in Tables 3 and 4. Expressive language, receptive language and PIQ showed no significant variation between the groups. Reading skills, in particular, reading comprehension difficulties were strongly associated with persistent conduct/hyperactivity symptoms. Children who had few if any conduct problems (resolving hyperactivity and low-level/no-problems trajectory groups) were significantly more prosocial than any of the children who exhibited persistent conduct problems or conduct problems at some point during childhood and/or adolescence.

Table 2. Gender, conduct and hyperactivity by trajectory groups.

	Persistent $n = 25$ (15%)	Adolescent-onset $n = 39$ (24%)	Childhood limited $n = 27$ (17%)	Resolving hyperactivity $n = 26$ (16%)	Low level/no problem $n = 47$ (29%)
Gender					
% Male	80	87	74	69	70
% Female	20	13	26	31	30
Conduct					
Rutter conduct problem scores at 7	3.2 (2.4)	0.3 (0.5)	2.6 (1.6)	0.3 (0.5)	0.0 (0.2)
Rutter conduct problem scores at 8	3.2 (2.7)	0.4 (0.8)	3.0 (2.6)	0.2 (0.5)	0.1 (0.3)
Rutter conduct problem scores at 11	5.4 (2.5)	0.9 (1.2)	1.0 (0.9)	0.3 (0.6)	0.0 (0.2)
SDQ conduct problem scores at 11	5.4 (1.6)	1.2 (1.3)	1.2 (0.9)	0.3 (0.5)	0.1 (0.3)
SDQ conduct problem scores at 16	2.9 (1.7)	2.5 (1.7)	0.3 (0.7)	0.2 (0.5)	0.0 (0.2)
SDQ above borderline conduct at 11	100%	18%	8%	0	0
SDQ above borderline conduct at 16	58%	44%	0	0	0
Hyperactivity					
Rutter hyperactivity scores at 7	2.5 (1.9)	0.6 (1.3)	2.3 (1.9)	3.5 (1.6)	0.2 (0.8)
Rutter hyperactivity scores at 8	3.1 (2.0)	0.8 (1.2)	2.9 (2.2)	2.9 (1.8)	0.3 (0.5)
Rutter hyperactivity scores at 11	3.8 (1.4)	1.7 (1.3)	1.9 (1.4)	2.4 (1.3)	0.7 (0.7)
SDQ hyperactivity scores at 11	6.9 (1.9)	3.7 (2.1)	4.1 (2.2)	4.5 (1.9)	2.0 (1.4)
SDQ hyperactivity scores at 16	6.0 (2.9)	6.0 (2.8)	2.4 (1.6)	2.5 (1.7)	1.5 (1.5)
SDQ above borderline hyperactivity at 11	78%	21%	24%	32%	0
SDQ above borderline hyperactivity at 16	62%	46%	0	5%	3%

For conduct and hyperactivity mean scores are reported with standard deviations in parentheses. SDQ: Strengths and Difficulties Questionnaire.

Table 3. Trajectory groups means (SD) for language, reading and prosocial skills.

	Persistent $n = 25$ (15%)	Adolescent-onset $n = 39$ (24%)	Childhood limited $n = 27$ (17%)	Resolving hyperactivity $n = 26$ (16%)	Low level/no problems $n = 47$ (29%)	ANOVA
Expressive language	71.9 (8.6)	76.2 (14.2)	71.2 (10.9)	72.0 (10.1)	73.7 (11.5)	$F(4157) = 1.02$
Receptive language	84.6 (14.7)	92.4 (16.5)	83.3 (15.8)	85.7 (16.5)	85.1 (14.0)	$F(4157) = 1.87$
PIQ	80.4 (19.5)	89.0 (25.0)	85.8 (24.6)	81.7 (23.8)	90.3 (23.9)	$F(4157) = 1.08$
Reading accuracy	75.9 (17.5)	81.9 (13.8)	82.4 (16.8)	79.1 (13.6)	82.9 (12.2)	$F(4157) = 1.17$
Reading comprehension	68.0 (17.3)	77.7 (13.3)	72.4 (15.3)	75.9 (14.6)	77.8 (11.2)	$F(4157) = 2.59^*$
SDQ prosocial scores at 11	4.3 (2.4)	5.8 (2.7)	5.8 (2.4)	7.5 (2.6)	7.4 (2.3)	$F(4142) = 7.87^{***}$

$^*p < .05$, $^{***}p < .001$. All scores represent standard scores with the exception of the SDQ scores which are on a scale of 0–10. Higher scores represent better performance for all measures. ANOVA: analysis of variance; PIQ: performance IQ; SDQ: Strengths and Difficulties Questionnaire.

Table 4. Pairwise comparisons for reading comprehension and prosociality across trajectory groups.

	1	2	3	4	5
Reading comprehension					
1. Persistent	0				
2. Adolescent-onset	**t(61) = 2.67**** **9.6[2.5, 16.7]**	0			
3. Childhood limited	t(49) = 1.11 4.3[−3.4, 12.1]	t(62) = −1.48 −5.3[−12.3, 1.8]	0		
4. Resolving hyperactivity	**t(49) = 2.00*** **7.8[0.1, 15.6]**	t(62) = −0.50 −1.8[−8.8, 5.3]	t(50) = 0.90 3.5[−4.2, 11.2]	0	
5. Low level/no problems	**t(67) = 2.79*** **9.8[2.9, 16.7]**	t(80) = 0.06 0.2[−5.9, 6.3]	t(68) = 1.58 5.45[−1.4, 12.3]	t(68) = 0.56 2.0[−4.9, 8.8]	0
SDQ prosocial score					
1. Persistent	0				
2. Adolescent-onset	**t(53) = 2.4*** **1.6[0.3, 3.0]**	0			
3. Childhood limited	**t(45) = 2.2*** **1.6[0.2, 3.0]**	t(56) = −0.1 −0.0[−1.3, 1.2]	0		
4. Resolving hyperactivity	**t(45) = 4.5***** **3.3[1.8, 4.7]**	**t(56) = 2.5*** **1.6[0.3, 2.9]**	**t(48) = 2.4*** **1.7[0.3, 3.1]**	0	
5. Low level/no problems	**t(62) = 4.9***** **3.1[1.9, 4.4]**	**t(73) = 2.6**** **1.5[0.4, 2.6]**	**t(65) = 2.5*** **1.6[0.3, 2.8]**	t(65) = −0.2 −0.1[−1.3, 1.1]	0

$^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$. Values are t(df) = t-statistic mean difference [95% CI]. Values in bold represent statistically different pairwise comparisons. SDQ: Strengths and Difficulties Questionnaire.

Discussion

The presence of additional challenging behaviours in children with LI increases the complexity and stresses of the tasks facing caregivers and teachers and expands the symptoms presenting to speech and language therapists. The presence of such difficulties in children with LI also complicates clinical management and compounds the children's risks of adverse psychosocial outcomes (Fergusson, Horwood, & Ridder, 2005). A subgroup of individuals (15% of the total sample) emerged as having persistent conduct disorder and hyperactivity problems from childhood to adolescence. The trajectory models classify individuals between the persistent and transient (childhood limited) groups with considerable confidence. The models classify on the basis of the whole data history, capturing important longitudinal information. This information can also be clinically important. The significant association of persistent conduct/hyperactivity problem with reading difficulties helps clinicians to identify early children who are most at-risk.

The proportion of children in the adolescent-onset group identified here (24%) is similar to what would be expected for a general population sample (c. 20%, Odgers et al., 2008). Clinicians need to be aware that adolescence can be a vulnerable period for a substantial proportion of children who may have previously manifested relatively low levels of behavioural problems, and that children with LI are no exception. Assessment (and if appropriate intervention) of conduct/hyperactivity problems in the transition to adolescence is clearly warranted. The difficulties of children with LI can be interpreted in terms of some of the reactive mechanisms proposed for adolescent-onset trajectory groups identified in general population samples. For example, a lack of positive engagement in school might be especially relevant to this group of children.

It is interesting to note that conduct problems always co-occurred with hyperactivity in this sample of children with LI. We did not find children who had conduct problems without hyperactivity regardless of differences in the trajectory of their symptoms. General population-based data suggest conduct problems can occur in isolation (D'Amico et al., 2014), but we did not observe this in children with LI. Furthermore, on average, hyperactivity symptoms were more pronounced than conduct problems. These findings are consistent with the fact that ADHD is the most common psychiatric diagnosis of children with LI (Cohen et al., 2000). Children with LI are over one and half times more likely to meet criteria for ADHD than their peers (Yew & O'Kearney, 2013). The findings of this study thus

indicate the need to include a psychological component to the clinical management of children with LI. This suggestion has been made by a number of investigators over the past two decades (Toppelberg & Shapiro, 2000; Yew & O'Kearney, 2013). What this study adds is a more specific recommendation that hyperactivity should be a key area for assessment in children with LI. Hyperactivity, in particular restlessness/fidgeting items, is in effect a red flag for co-occurring conduct problems in children and young people with LI.

From a clinical perspective, it is also important to note that the group with hyperactivity but not conduct problems would be distinguishable from the other groups from data in childhood. While their outcome does not appear to be unusually poor – for example, they are prosocial and their problem symptoms appear to resolve by late adolescence – their distinctive inattention and distractibility profile might imply a distinctive aetiology. Investigating the impact on their language problems of existing treatments for ADHD would be of interest.

Prosociality appeared to be protective against conduct problems. The two trajectory groups that did not show conduct problems were significantly more prosocial than every other trajectory group that exhibited conduct problems. The buffering effects of prosociality in LI have been documented for social domains (Mok et al., 2014). To our knowledge, this is the first study to provide evidence of positive effects with regard to conduct difficulties. The developmental processes by which prosocial behaviours may protect children with LI from developing conduct problems are unclear. Social interactions with peers in non-demanding communicative contexts such as playing sports, may prevent the development of problem behaviours by allowing children to engage successfully in social contexts which foster self-regulation and inhibitory control (Wolfe & Bell, 2004). Prosociality may also afford positive interactions, for example, being kind and helpful to younger peers, whereby children with LI are able to communicative more effectively with less language-demanding conversational partners. Research aimed at better understanding potential protective mechanisms afforded by prosociality in children with LI is an important area for future research.

We did not find gender effects in terms of distinct trajectories of conduct and hyperactivity symptoms. Girls with LI were as likely as boys with LI to follow particular trajectories. We acknowledge, however, that the study of gender effects in LI is complex as boys tend to attract more attention than girls (Shaywitz, Shaywitz, Fletcher, & Escobar, 1990). We know, for example, that boys are more likely than girls to be referred to services (ratio of 3:1 in the MLS; Conti-Ramsden, 2013; Conti-Ramsden & Botting, 1999b). This reduces the power to identify gender differences given the small pool of females with LI available.

Finally, it is important to note two further points. First, our study was based on teacher-reported behaviour. Children may have had different teachers or attended different school systems along their development trajectories and this raises challenges when comparing longitudinal results of reported data. Parental reporting on the other hand serves the possibility of rater continuity across all time points. Future research with parent- or indeed peer-reported ratings may provide additional insights and different perspectives. Our investigation made use of recalling sentences as a measure of expressive language. Future research could useful include multi-sentential measures of oral abilities, for example, spontaneous language samples which may examine in more detail potential trajectory group differences. In addition, our study uses a language unit sample that is likely to include children with severe language problems. Hence, our findings may not be generalisable to, for example, community-based samples of children with LI who may exhibit difficulties in the more mild to moderate range. These are areas that could usefully be addressed in future research. Second, nearly one-third of children with LI (29%) do not experience conduct problems or hyperactivity during childhood and this continues to be the case in adolescence. These children with LI had better literacy skills than other children in the MLS, albeit still below 1 SD from the population mean. Importantly, these children were quite prosocial. We suggest that high levels of prosociality confer resilience to children and young people facing challenges with learning their first language.

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